CONESTOGA-ROVERS
& ASSOCIATES

261 Martindale Road, Unit #3, St. Catharines, Ontario L2W 1A2
Telephone: 905·682·0510 Facsimile: 905·682·8818
www.CRAworld.com

June 26, 2009

Reference No. 056393

Mr. Michael Berkoff
Remedial Project Manager
U.S. Environmental Protection Agency – Region V
Superfund Division, Remedial Response Section #2
77 West Jackson Boulevard (SR – 6J)
Chicago, Illinois 60604 - 3590



Dear Mr. Berkoff:

Re: Performance Standards Verification Plan
12th Street Landfill Operable Unit No.4
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Allegan and Kalamazoo County

On behalf of Weyerhaeuser Company (Weyerhaeuser), attached please find three copies of the Conestoga-Rovers & Associates' (CRA's) revisions to the Performance Standards Verification Plan (PSVP), Appendix D to the Pre-Final Design report for the 12th Street Landfill, Operable Unit No.4, Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site, Allegan and Kalamazoo County (Site).

Section of the PSVP have been amended to reflect the design changes as presented in the Pre-Final Design Report -Addendum No. 1 which was provided to the United States Environmental Protection Agency (U.S. EPA) on June 17, 2009 and to reflect CRA performing the work. Given that the revisions to the PSVP are relatively minor and CRA will follow the field methods outlined by RMT expect where noted in the attached, CRA is only providing information that has changed rather than submitting an entire revised document.

The revisions include:

- Table 1 summarizes the required revisions to the text. It is CRA's assumption that the recent revision of the reports and documents that have been provided to U.S. EPA on behalf of Weyerhaeuser will supersede the documents cited as references in the PSVP's text. Please note that CRA will employ instruments and equipment (as indicated in Attachment 1: Standard Operating Procedures of the PSVP) or their equivalent to gather, generate, or measure environmental data;

- Attachment A to this letter provides Table 4.1 of the PSVP that was revised to reflect CRA's Field Training Manual procedures;

- Attachment B to this letter provides CRA's relevant field forms/logs to replace the forms provided by RMT; and

- Attachment C to this letter provides two new SOPs, describing the additional field procedures as summarized in Phase II RI Work Plan for Plainwell, Inc. Mill Property and RA Work Plan for 12th Street Land Fill. The additional SOPs includes:

    a) Monitoring Well Installation Procedures (i.e., F-15); and
    b) Surface Water Sampling Procedures (i.e., F-16).

Should you have any questions or require any additional information, please do not hesitate to contact the undersigned.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Gregory A. Carli, P. E.

GB/gb/6
Encl.

c.c.: Paul Bucholtz (MDEQ) - three copies
Marvin Lewallen (Weyerhaeuser)
Richard Gay (Weyerhaeuser)
Martin Lebo (Weyerhaeuser)
Joe Jackowski (Weyerhaeuser) - w/o enclosure
Michael Erikson (Arcadis)
Glenn Turchan (CRA) - w/o enclosure
Jodie Dembowske (CRA) - w/o enclosure

# TABLE 1

## SUMMARY OF CHANGES
## PERFORMANCE STANDARDS VERIFICATION PLAN
## 12TH STREET LANDFILL
## OTSEGO TOWNSHIP, MICHIGAN

| *Page* | *Basis* | *Amendments* |
|---|---|---|
| 4 | Update Paragraph 2 of the Section 2.3 with revised estimated areal extent of paper residual on the MDNR's property | "3,350 $Ft^2$ (0.08 acre)" revised to "3,700 $Ft^2$ (0.085 acre)" |
| 4 | Update Paragraph 2 of the Section 2.3 with revised estimated areal extent of paper residual on the asphalt plant property | "31,900 $Ft^2$ (0.7 acre)" revised to "32,000 $Ft^2$ (0.7 acre)" |
| 5 | Paragraph 1 of section 2.4.1, identify methanol preservation method will be conducted in the field | "the methanol" changed to "the field methanol" |
| 6 | Update Paragraph 1 of section 2.7 with the revised schedule for verification soil sampling tasks | The schedule for the verification soil sampling task is as follows:<br>• At the MDNR property, the excavation of paper residuals, collection and quick-turn analysis of soil samples, data validation, and assessment is scheduled between September 2009 and October 2009;<br>• At the asphalt plant property, the excavation of paper residuals, collection and quick-turn analysis of soil samples, data validation, and assessment is scheduled between April 2009 and May 2009; and<br>• Submittal of the Certification of Completion Report to U.S. EPA is scheduled between October 2010. |
| 8 | Update Paragraph 1 of section 3.3.1 with the current Drawing number | "Sheet 3 in the Design Report" changed to "Drawing C-04 in the Pre-Final Design Report - Addendum No.1" |
| 8 | Update Paragraph 1 of section 3.3.2 with the current Drawing number | "Sheet 3 in the Design Report" changed to "Drawing C-04 in the Pre-Final Design Report - Addendum No.1" |
| 16 | Paragraph 3 of section 4.3.5, replaced RMT field forms with appropriate CRA field forms | RMT field forms were replaced by their equivalent CRA field forms |

ATTACHMENT A

REVISED TABLE 4-1

**TABLE 4.1**

**STABILIZATION CRITERIA FOR GSI WELL PURGING**
**12TH STREET LANDFILL**
**OTSEGO TOWNSHIP, MICHIGAN**

| *Parameters* | *Criteria* [1] |
|---|---|
| pH | ±0.1 pH units of the average value of the three readings |
| Temperature | ±3 percent of the average value of the three readings |
| Conductivity | ±0.005 milliSiemen per centimeter (mS/cm) of the average value of the three readings for conductivity <1 mS/cm and ±0.01 mS/cm of the average value of the three readings for conductivity >1 mS/cm; |
| Oxidation Reduction Potential (ORP) | ±10 millivolts (mV) of the average value of the three readings |
| Dissolved Oxygen (DO) | ±10 percent of the average value of the three readings |
| Turbidity | ±10 percent of the average value of the three readings, or a final value of less than 5 NTU. |

**Notes:**

[1] Stabilization criteria may modified during sampling based on field observations.

# ATTACHMENT B

# CRA'S RELEVANT FIELD FORMS/LOGS

Date: _____ Reference No.: _____

## PROJECT PLANNING COMPLETION AND FOLLOW-UP CHECKLIST

PRIOR PLANNING AND COORDINATION:

- ☐ Confirm well numbers, location and accessibility
- ☐ Review of project documents, Health and Safety Plan (HASP), sampling Quality Assurance/Quality Control (QA/QC) and site-specific sampling requirements
- ☐ Historical well data; depth, pH, performance and disposition of purge water
- ☐ Site access notification and coordination
- ☐ Coordination with laboratory through CRA Chemistry Group
- ☐ Procurement, inventory and inspection of all equipment and supplies
- ☐ Prior equipment preparation, calibration or maintenance
- ☐ All utilities located and approved

FIELD PROCEDURE:

- ☐ Instruments calibrated daily
- ☐ Sampling equipment decontaminated in accordance with the QAPP
- ☐ Field measurements and sampling details logged in appropriate field books or an appropriate field form
- ☐ Well volume calculated and specified volumes removed
- ☐ Specified samples, and QA/QC samples taken per Quality Assurance Project Plan (QAPP)
- ☐ Samples properly labeled, preserved and packed
- ☐ Sampling locations secured or completed according to Work Plan
- ☐ Sample date times, locations and sample numbers have all been recorded in applicable log(s)
- ☐ Samples have been properly stored if not shipped/delivered to lab same day
- ☐ Samples were shipped with complete and accurate Chain of Custody Record

FOLLOW-UP ACTIVITIES:

- ☐ Questionable measurements field verified
- ☐ Confirm all samples collected
- ☐ All equipment has been maintained and returned
- ☐ Sampling information reduced and required sample keys and field data distributed
- ☐ Chain of Custody Records filed
- ☐ Expendable stock supplies replaced
- ☐ CRA and client-controlled items returned (i.e., keys)
- ☐ Arrange disposal of investigation generated wastes with client
- ☐ Confirm all samples collected

Completed by: _____ Date: _____

**CRA**

# WELL PURGING FIELD INFORMATION FORM

JOB# _____ - _____

*SITE/PROJECT NAME:* _____ WELL# _____

## WELL PURGING INFORMATION

| PURGE DATE (MM DD YY) | SAMPLE DATE (MM DD YY) | WATER VOL. IN CASING (LITRES/GALLONS) | ACTUAL VOLUME PURGED (LITRES/GALLONS) |
|---|---|---|---|
| | | | |

## PURGING AND SAMPLING EQUIPMENT

PURGING EQUIPMENT.....DEDICATED Y N (CIRCLE ONE)

SAMPLING EQUIPMENT.....DEDICATED Y N (CIRCLE ONE)

| | | | | | |
|---|---|---|---|---|---|
| PURGING DEVICE | [ ] | A - SUBMERSIBLE PUMP<br>B - PERISTALTIC PUMP | D - GAS LIFT PUMP<br>E - PURGE PUMP | G - BAILER<br>H - WATERRA® | X- _____ PURGING OTHER (SPECIFY) |
| SAMPLING DEVICE | [ ] | C - BLADDER PUMP | F - DIPPER BOTTLE | | X- _____ SAMPLING OTHER (SPECIFY) |
| PURGING MATERIAL | [ ] | A - TEFLON<br>B - STAINLESS STEEL | D - PVC<br>E - POLYETHYLENE | | X- _____ PURGING OTHER (SPECIFY) |
| SAMPLING MATERIAL | [ ] | C - POLYPROPYLENE | | | X- _____ SAMPLING OTHER (SPECIFY) |
| TUBING PURGING | [ ] | A - TEFLON<br>B - TYGON | D - POLYPROPYLENE<br>E - POLYETHYLENE | F - SILICONE<br>G - COMBINATION TEFLON/POLYPROPYLENE | X- _____ PURGING OTHER (SPECIFY) |
| TUBING SAMPLING | [ ] | C - ROPE x- _____ (SPECIFY) | | | X- _____ SAMPLING OTHER (SPECIFY) |
| FILTERING DEVICES 0.45 | [ ] | A - IN-LINE DISPOSABLE | B - PRESSURE | C - VACUUM | |

## FIELD MEASUREMENTS

| | | | |
|---|---|---|---|
| WELL ELEVATION | (m/ft) | GROUNDWATER ELEVATION | (m/ft) |
| DEPTH TO WATER | (m/ft) | WELL DEPTH | (m/ft) |

| pH | TURBIDITY | CONDUCTIVITY | SAMPLE TEMPERATURE |
|---|---|---|---|
| (std) | (ntu) | (µm/cm) AT 25°C | (°C) |
| (std) | (ntu) | (µm/cm) AT 25°C | (°C) |
| (std) | (ntu) | (µm/cm) AT 25°C | (°C) |
| (std) | (ntu) | (µm/cm) AT 25°C | (°C) |
| (std) | (ntu) | (µm/cm) AT 25°C | (°C) |

## FIELD COMMENTS

SAMPLE APPEARANCE: _____ ODOR: _____ COLOR: _____ TURBIDITY: _____

WEATHER CONDITIONS: WIND SPEED _____ DIRECTION _____ PRECIPITATION Y/N OUTLOOK _____

SPECIFIC COMMENTS _____

I CERTIFY THAT SAMPLING PROCEDURES WERE IN ACCORDANCE WITH APPLICABLE CRA PROTOCOLS

**CRA** DATE _____ PRINT _____ SIGNATURE _____

# SAMPLE COLLECTION DATA SHEET - GROUNDWATER SAMPLING PROGRAM

PROJECT NAME _____ PROJECT NO. _____

SAMPLING CREW MEMBERS _____ SUPERVISOR _____

DATE OF SAMPLE COLLECTION _____

[Note: For 2" dia. well, 1 ft. = 0.14 gal (imp) or 0.16 gal (us)]

| Sample I.D. Number | Well Number | Measuring Point Elev. (ft. AMSL) | Bottom Depth (ft. btoc) | Water Depth (ft. btoc) | Water Elevation (ft. AMSL) | Well Volume (gallons) | Bailer Volume No. Bails | Volume Purged (gallons) | Field pH | Field Temp. | Field Cond. | Time | Sample Description & Analysis |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Additional Comments: _____

Copies to: _____

**CRA**

## MONITORING WELL RECORD FOR LOW-FLOW PURGING

***Project Data:***

Project Name: _____ Date: _____

Ref. No.: _____ Personnel: _____

***Monitoring Well Data:***

Well No.: _____

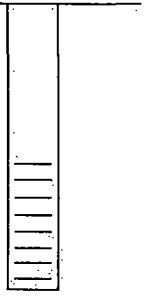
Vapour PID (ppm): _____ Saturated Screen Length (m/ft): _____

Measurement Point: _____ Depth to Pump Intake (m/ft)[1]: _____

Constructed Well Depth (m/ft): _____ Well Diameter, D (cm/in): _____

Measured Well Depth (m/ft): _____ Well Screen Volume, $V_s$ (L)[2]: _____

Depth of Sediment (m/ft): _____ Initial Depth to Water (m/ft): _____



| *Time* | *Pumping Rate (mL/min)* | *Depth to Water (m/ft)* | *Drawdown from Initial Water Level[3] (m/ft)* | *Temperature °C* | *Conductivity (mS/cm)* | *Turbidity NTU* | *DO (mg/L)* | *pH* | *ORP (mV)* | *Volume Purged, Vp (L)* | *No. of Well Screen Volumes Purged[4]* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Precision Required[5]:* | | *±3 %* | *±0.005 or 0.01[6]* | *±10 %* | *±10 %* | *±0.1 Units* | *±10 mV* | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Notes:

(1) The pump intake will be placed at the well screen mid-point or at a minimum of 0.6 m (2 ft) above any sediment accumulated at the well bottom.

(2) The well screen volume will be based on a 1.52 metres (5-foot) screen length (L). For metric units, $V_s=\pi*(r^2)*L$ in mL, where r (r=D/2) and L are in cm. For Imperial units, $V_s=\pi*(r^2)*L*(2.54)^3$, where r and L are in inches

(3) The drawdown from the initial water level should not exceed 0.1 m (0.3 ft). The pumping rate should not exceed 600 mL/min.

(4) Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing), No. of Well Screen Volumes Purged= Vp/Vs.

(5) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

# WATER LEVEL RECORD

PROJECT NAME: _____ LOCATION: _____

JOB NO. : _____ DATE: _____

CLIENT: _____ ENGINEER/GEOLOGIST: _____

| OBSERVATION WELL | TOP OF CASING ELEVATION A | | DEPTH TO WATER B | | WATER LEVEL ELEVATION A-B | |
|---|---|---|---|---|---|---|
| | feet | metres | feet | metres | feet | metres |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

CRA

*Date:* _____ *Reference No.* _____

# BOREHOLE INSTALLATION/SOIL SAMPLING EQUIPMENT AND SUPPLY CHECKLIST

*INSTRUMENTS*

- ☐ Steel Tape (50 foot)
- ☐ Air Monitoring Equipment
- ☐ Water Level Meter
- ☐ Pocket Penetrometer

*SUPPLIES*

- ☐ Foil
- ☐ Plastic Sample Bags
- ☐ Paper towels
- ☐ Decontamination Fluids (as required by QAPP)
- ☐ Deionized water
- ☐ Labels
- ☐ Sample knives
- ☐ Trash bags
- ☐ Plastic spray bottles
- ☐ Sampling Glassware
- ☐ Coolers

*PERSONAL PROTECTIVE EQUIPMENT*

- ☐ Tyveks (assorted sizes and types)
- ☐ Protective gloves
- ☐ Hard hats/liner(s)
- ☐ Field overboots
- ☐ Work gloves (cotton and chemical resistant)
- ☐ Safety glasses or OSHA-approved prescription lenses
- ☐ First Aid Kit
- ☐ Respirators and Cartridges
- ☐ Check Health and Safety Plan

*DOCUMENTATION*

- ☐ Notebook/Field book
- ☐ Photolog
- ☐ Site pass/badge
- ☐ Previous well logs/previous historical well data
- ☐ Site map
- ☐ Access Agreement Documentation
- ☐ Utility Clearance Documentation
- ☐ Stratigraphic Log (Overburden) - at least one for each 20 feet of drilling
- ☐ Chain-of-Custody Forms

*MISCELLANEOUS*

- ☐ Camera/film
- ☐ Spare batteries for instruments
- ☐ Carpenters Rule (6 foot)
- ☐ Clipboard
- ☐ Indelible Pen/pencil/indelible marking pen
- ☐ Tool box
- ☐ Spare locks/keys
- ☐ On Site Transportation (all Terrain Vehicle/Snowmobiles)

* Do not use pen with water soluble ink

*Completed by:* _____ *Date:* _____

**CRA**

# STRATIGRAPHY LOG (OVERBURDEN)

PAGE ____ OF ____

PROJECT NAME _____
PROJECT NUMBER _____
CLIENT _____
LOCATION _____

DRILLING CONTRACTOR _____
DRILLER _____
SURFACE ELEVATION _____
WEATHER (A.M.) _____
(P.M.) _____

HOLE DESIGNATION _____
DATE/TIME STARTED _____
DATE/TIME COMPLETED _____
DRILLING METHOD _____
CRA SUPERVISOR _____

| STRATIGRAPHIC INTERVALS (DEPTHS IN ft/m BGS) | | | SAMPLE DESCRIPTION | SAMPLE DETAILS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FROM | AT | TO | ORDER OF DESCRIPTORS:<br>SOIL TYPE SYMBOL(S) – PRIMARY COMPONENT(S), (NATURE OF DEPOSIT), SECONDARY COMPONENTS, RELATIVE DENSITY/CONSISTENCY, GRAIN SIZE/PLASTICITY, GRADATION/STRUCTURE, COLOUR, MOISTURE CONTENT, SUPPLEMENTARY DESCRIPTORS<br>NOTE: PLASTICITY DETERMINATION REQUIRES THE ADDITION OF MOISTURE IF THE SAMPLE IS TOO DRY TO ROLL (INDICATE IF MOISTURE WAS ADDED OR NOT). | SAMPLE # | SAMPLING METHOD | PENETRATION RECORD SPLIT SPOON BLOWS (RECORD N-VALUES & RECOVERIES) 6" | 6" | 6" | 6" | N | R | SAMPLE INTERVAL | PID / FID (ppm) | CHEMICAL ANALYSIS | GRAIN SIZE |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

NOTES AND COMMENTS

DEPTH OF BOREHOLE CAVING _____ DEPTH OF FIRST GROUNDWATER ENCOUNTER _____ TOPSOIL THICKNESS _____

WATER LEVEL IN OPEN BOREHOLE ON COMPLETION _____, AFTER ____ HOURS ____

COMPLETION DETAILS: _____

NOTE: FOR EACH SPLIT-SPOON SAMPLE, RECORD BLOW COUNTS, N-VALUE, SAMPLE RECOVERY LENGTH, AND SAMPLE INTERVAL.

NOTES:

# SOIL CLASSIFICATION SYSTEM (MODIFIED U.S.C.S.)

| MAJOR DIVISIONS | | | GROUP SYMBOL | TYPICAL DESCRIPTION |
|---|---|---|---|---|
| HIGHLY ORGANIC SOILS | | | PT | PEAT AND OTHER HIGHLY ORGANIC SOILS |
| COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN NO. 200 SIEVE SIZE) | GRAVELS MORE THAN HALF OF COARSE FRACTION LARGER THAN NO.4 SIEVE SIZE | CLEAN GRAVELS | GW | WELL GRADED GRAVEL, GRAVEL-SAND MIXTURES, < 5 % FINES |
| | | | GP | POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, < 5 % FINES |
| | | DIRTY GRAVELS | GM | SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, > 12 % FINES |
| | | | GC | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, > 12 % FINES |
| | SANDS MORE THAN HALF OF COARSE FRACTION SMALLER THAN NO.4 SIEVE SIZE | CLEAN SANDS | SW | WELL GRADED SANDS, GRAVELLY SANDS, < 5 % FINES |
| | | | SP | POORLY GRADED SANDS, OR GRAVELLY SAND, < 5 % FINES |
| | | DIRTY SANDS | SM | SILTY SANDS, SAND-SILT MIXTURES > 12 % FINES |
| | | | SC | CLAYEY SANDS, SAND-CLAY MIXTURES > 12 % FINES |
| FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSES NO. 200 SIEVE SIZE) | SILTS BELOW "A" LINE ON PLASTICITY CHART; NEGLIGIBLE ORGANIC CONTENT | | ML | INORGANIC SILTS AND VERY FINE SAND, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY |
| | | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS |
| | CLAYS ABOVE "A" LINE ON PLASTICITY CHART; NEGLIGIBLE ORGANIC CONTENT | | CL | INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS |
| | | | CI | INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS |
| | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS |
| | ORGANIC SILTS & ORGANIC CLAYS BELOW "A" LINE ON PLASTICITY CHART | | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | | | OH | ORGANIC CLAYS OF HIGH PLASTICITY |

# CONVENTIONAL SOIL DESCRIPTIONS

## NON-COHESIVE (GRANULAR) SOIL

| RELATIVE DENSITY | BLOWS PER FOOT (N-VALUE) |
|---|---|
| Very loose | less than 5 |
| Loose | 5 to 9 |
| Compact | 10 to 29 |
| Dense | 30 to 50 |
| Very Dense | greater than 50 |

## COHESIVE (CLAYEY) SOIL

| CONSISTENCY | BLOWS PER FOOT (N-VALUE) |
|---|---|
| Very Soft | 0 to 2 |
| Soft | 3 to 4 |
| Firm | 5 to 8 |
| Stiff | 9 to 15 |
| Very Stiff | 16 to 30 |
| Hard | greater than 30 |

## GRAIN SIZE CLASSIFICATION

| | |
|---|---|
| COBBLES | Greater than 3 inches (76 mm) |
| GRAVEL | 3 in. to No. 4 (4.76 mm) |
| Coarse Gravel | 3 in. to 3/4 in. |
| Fine Gravel | 3/4 in. to No. 4 (4.76 mm) |
| SAND | No. 4 (4.76 mm) to No. 200 (0.074 mm) |
| Coarse Sand | No. 4 (4.76 mm) to No. 10 (2.0 mm) |
| Medium Sand | No. 10 (2.0 mm) to No. 40 (0.42 mm) |
| Fine Sand | No. 40 (0.42 mm) to No. 200 (0.074 mm) |
| SILT | No. 200 (0.074 mm) to 0.002 mm |
| CLAY | Less than 0.002 mm |

NOTE: The "No. __ " refers to the standard sieve sizes.

## COMPONENT PERCENTAGE DESCRIPTORS

| | |
|---|---|
| Noun(s) (e.g. SAND and GRAVEL) | 35 to 50 % |
| Adjective (e.g. SANDY) | 20 to 35 % |
| With | 10 to 20 % |
| Trace | Less than 10 % |

## SOIL STRUCTURE TERMS

| | |
|---|---|
| Stratified | Blocky |
| Laminated | Lenses/Seams |
| Fissured | Homogeneous |

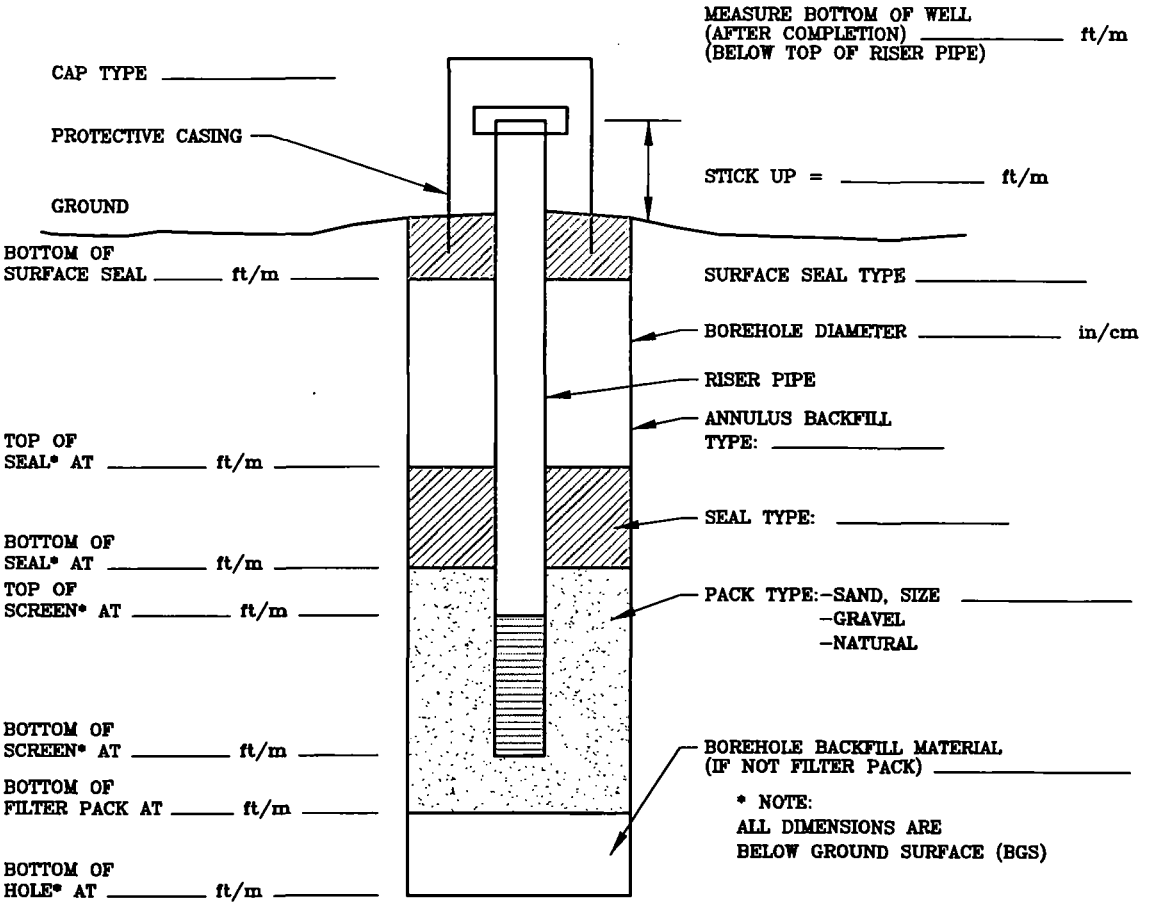
# WELL INSTRUMENTATION LOG

PROJECT NAME _____ WELL DESIGNATION _____

PROJECT NUMBER _____ DATE COMPLETED _____

CLIENT _____ DRILLING METHOD _____

LOCATION _____ CRA SUPERVISOR _____




SCREEN TYPE: ☐ continuous slot ☐ wire wrapped ☐ louvre ☐ other: _____

SCREEN MATERIAL: ☐ stainless steel ☐ pvc ☐ other: _____

SCREEN LENGTH: _____ ft/m SCREEN DIAMETER: _____ in/cm SCREEN SLOT SIZE: _____

RISER PIPE MATERIAL: _____ RISER PIPE DIAMETER: _____ in/cm

SURFACE CASING (Y/N) _____ MATERIAL _____ DEPTH _____ ft/m

DIAMETER _____ in/cm SEALANT _____

DEVELOPMENT: METHOD: _____ DURATION: _____

DESCRIPTION OF PURGED WATER: _____

_____

*Date:* _____ *Reference No.* _____

# EQUIPMENT AND SUPPLY CHECKLIST
# SURFACE WATER SAMPLING, SEDIMENT SAMPLING, AND FLOW MEASUREMENT

*INSTRUMENTS:*

- ☐ Measuring tape
- ☐ Steel tape (100 ft)
- ☐ Air monitoring equipment
- ☐ Velocity meter
- ☐ Flow meter
- ☐ Depth recorder/data logger
- ☐ Calculator
- ☐ Laptop computer with communication cable
- ☐ Stop watch
- ☐ Camera

*EQUIPMENT:*

- ☐ Sampling telescopic pole
- ☐ Sampling scoop/bucket
- ☐ Boat/motor (if required)
- ☐ Bailers
- ☐ Kemmerer/Van Dorn sampler
- ☐ Peterson/Ponar Dredge
- ☐ Core sampler/split spoon sampler
- ☐ Stainless steel mix bowl
- ☐ Hand tools
- ☐ Other _____

*SUPPLIES*

- ☐ Foil
- ☐ Paper towels
- ☐ Decontamination Fluids (as required by Work Plan)
- ☐ Deionized Water
- ☐ Labels
- ☐ Sample knives
- ☐ Trash bags
- ☐ Sample Glassware
- ☐ T-bars/stakes
- ☐ Duct tape
- ☐ Markers
- ☐ Film
- ☐ Paint
- ☐ Thumbtacks

*DOCUMENTATION*

- ☐ Topographic Maps
- ☐ Notebook/Field book
- ☐ Photolog
- ☐ Site pass/badge
- ☐ Site Map
- ☐ Work Plan

*PERSONAL PROTECTIVE EQUIPMENT:*

- ☐ Waders/overboots
- ☐ Tyveks (if required)
- ☐ Life vest
- ☐ Safety line
- ☐ Protective gloves
- ☐ Hardhat
- ☐ Safety glasses
- ☐ First Aid Kit
- ☐ Check Health and Safety Plan

*Completed by:* _____ *Date:* _____

*Date:*_____ *Reference No.* _____

# LANDFILL GAS MONITORING EQUIPMENT AND SUPPLY CHECKLIST

*INSTRUMENTS:*

- O Water level indicator (Narrow Diameter) with measuring tape
- O Steel Tape
- O Plopper
- O Air Monitoring Equipment
- O Combustible Gas Instrument
- O Pressure Measuring Instrument
- O Digital Thermometer

*SUPPLIES:*

- O Foil
- O Paper towels
- O Decontamination Fluids (as required by Work Plan)
  - O 2 - Propanol
  - O Deionized water
  - O Hexane (pesticide grade)
  - O Methanol (pesticide grade)
  - O Other
- O Trash bags
- O Plastic spray bottles
- O Tubing (Tygon or teflon)
- O Assorted adaptors and connectors (to connect instrument to probe)

*PERSONAL PROTECTIVE EQUIPMENT:*

- O Tyveks (assorted sizes and types)
- O Latex gloves
- O Hard hats/liner(s)
- O Field overboots
- O Work gloves (cotton and chemical resistant)
- O Safety glasses/or side shields on OSHA-approved prescription lenses
- O First Aid Kit
- O Respirators
- O Check Health and Safety Plan
- O Confined Space Entry equipment

*DOCUMENTATION*

- O Notebook/field book
- O Site pass/badge
- O Previous well logs/previous historical well data
- O Site map
- O Blank landfill gas monitoring data forms
- O Property access/utility clearance
- O Confined Space Entry Permit

*MISCELLANEOUS*

- O Well Cap Keys
- O Bolt cutters
- O Camera/film
- O Knife
- O Spare batteries for instruments
- O Lock deicer (winter)
- O Measuring Tape
- O Pen/pencil/indelible marking pen
- O Tool box
- O Spare locks/keys
- O On site transportation (all Terrain Vehicle/Snowmobiles)

*Completed by:*_____ *Date:* _____

**CRA**

# FIELD DATA RECORD FORM
# MONITOR, PID, MINIRAE 2000

(QSF-295D)

**Control No.:** _____ **Project No.:** _____
**Date:** _____ **Project Name:** _____
**User:** _____ _____
**Location:** _____

**Additional Equipment Control Numbers and Descriptions:** _____

_____

_____

## FIELD PROCEDURE BEFORE USE:

| | *Check when completed* |
|---|---|
| • Gently unscrew the lamp housing cap. | |
| • Remove the sensor adaptor with the gas inlet probe, and remove the metal and dust filters from the probe using tweezers. | |
| • Check to ensure the probe is clean. | ☐ |
| • Replace the filters back into the probe cavity and replace the probe assembly. | |
| • Turn the PID on by pressing the (Mode) key. | |
| • During the warm-up period, check the pump inlet flow using your finger to detect suction. The warm-up ends when "Ready" is displayed. | ☐ |
| • Press the (Mode) key several times until the battery voltage is displayed. | |
| • Check battery level and record on the space provided. Recharge if below 4.4 V. | _____ V |
| • Press the (Mode) key several times until "Survey/Ready" is displayed. | |
| • Press and hold both the (Mode) and the (N/-) keys for 3 seconds. | |
| • At the prompt "Calibrate/select Gas?", press the (Y/+) key. | |
| • If calibrating in unclean air, attach the charcoal filter to the PID probe. | ☐ |
| • At the prompt "Fresh air cal?", press the (Y/+) key to begin the zero calibration. The display will indicate "zero in progress" followed by a 15 second waiting period. At the end of the calibration, "zeroed!" will be displayed followed by the zero reading. | |
| • Ensure that the instrument is properly zeroed. | ☐ |
| • Press any key to continue. Remove the charcoal filter from the PID probe. | |
| • At the prompt "Fresh air cal?", press the (N/-) key. | |
| • Place the regulator onto the calibration gas and connect to the PID probe. | ☐ |
| • At the prompt "Span cal?", press the (Y/+) key. | |
| • At the prompt "Apply gas now!", quickly turn on the calibration gas valve. The calibration takes 30 seconds after which the display will indicate "cal'ed!" followed by the calibration reading. | |
| • Ensure that the calibration reading is +/- 2 ppm of the calibration gas value. | ☐ |
| • Press any key to continue. | |
| • Turn off the valve of the calibration gas and disconnect from the PID. | |
| • Press the (Mode) key several times until the "Ready" prompt is displayed. | |
| • Press the (Y/+) key to start the measurement. | |
| • To end the measurements, press the (Mode) key followed by the (Y/+) key. | |
| • Press and hold the (Mode) key for 5 seconds to turn off the PID. | |

**Filing: Field File**

Signature: _____

**FIELD DATA:** **(QSF-295D)**

| *Sample No.* | *Time* | *Location* | *Reading* | *Comments* |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Filing: Field File**

**Project No:** _____ **Name (please print):** _____

**Date:** _____ **Signature:** _____

# PUMPED WELL - DRAWDOWN DATA

Project No.: _____ Project Name: _____

Date: _____ Project Location: _____

Pumped Well No.: _____ Type of Test: _____

CRA Supervisor: _____ W/L Before Pumping Ceased: _____

Screened Interval: _____ to _____ Pumping Rate (Q): _____

Aquifer Thickness: _____ Datum Point: _____ Datum Point Elevation _____ amsl

Static Water Level: _____ ☐ Confined ☐ Unconfined

| Time | | | Time (t) Since Pumping Stopped (min.) | Ratio t/t' | Water Level | Residual Drawdown | Remarks |
|---|---|---|---|---|---|---|---|
| Day | Hr. | Min. | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

CRA 1001 (29) Form SP25

ATTACHMENT C

STANDARD OPERATING PROCEDURES F-15
AND
STANDARD OPERATING PROCEDURES F-16

# Standard Operating Procedure F-15
# Monitoring Well Installation Procedures

This standard operating procedure (SOP) sets forth the field procedures for the installation of monitoring wells.

## Equipment

Equipment needed for installation of monitoring wells may include the following:

- Personal Protective Equipment (PPE) and safety equipment;
- Decontamination equipment;
- Maps, figures, or plot plans;
- Drilling method is selected based on site geologic and hydrogeologic conditions;
- PVC well screen and riser pipe;
- Stainless steel well screen and riser pipe;
- Stainless steel screen and black iron (low carbon steel) riser pipe;
- Stainless steel screen and PVC riser pipe;
- Sand pack;
- Filter pack placement;
- Bentonite seal;
- Grout;
- Protective casings and well caps;
- Surface seal;
- Protective posts (if required);
- Well development equipment including waterra, surge block, pumping/overpumping/backwashing, bailing, or airlifting;
- Camera and film; and
- Logbook.

## Decontamination Procedures

Prior to use and between each borehole location, drilling and sampling equipment must be decontaminated in accordance with the Work Plan, the QAPP, or the methods presented in the following section.

The minimum wash procedures for decontamination of drilling equipment are:

- High pressure hot water detergent wash (brushing as necessary to remove particulate matter); and
- Potable, hot water, high pressure rinse.

Cover the clean augers with clean plastic sheeting to prevent contact with foreign materials. For geotechnical, geologic, or hydrogeologic studies where no contaminants are present, it is sufficient to clean the drilling or excavating equipment simply by removing the excess soils.

**Monitoring Well Installation Procedure**

1. Select the exact location of each well consistent with the site and project requirements. If a well must be relocated more than 20 feet (5.7 m) from the initially identified location, confirm the new location's suitability with the Project Coordinator. Ensure all utilities have been cleared prior to initiating borehole advancement activities;
2. To the extent practical, wells should be located adjacent to permanent structures (e.g., fences, buildings) that offer some form of protection and a reference point for future identification. Wells located in high traffic areas or road allowances or low lying wet areas are undesirable, but may be unavoidable. Field tie ins must be completed to accurately identify each well location. These will ensure that the wells are properly identified on plans and for future identification in the field;
3. The following drilling methods are listed in order of preference. However, final selection will be based on Site geologic and hydrogeologic conditions. During drilling activities, it is required that detailed descriptions of the Site geologic conditions be documented:

    a. Hollow Stem Augering (HAS);
    b. Direct Push Drilling;
    c. Dual Wall Reverse Circulation Air Drilling;
    d. Rotosonic Drilling; and
    e. Rotary Method.

4. The diameter of a well is primarily dictated by the purpose of the well. Generally, wells installed for groundwater and hydraulic monitoring should be between 1 and 2 inches in diameter. The diameter is also dependent on the drilling method being used;
5. Screen length should be consistent with the hydrogeologic conditions and the desired monitored interval. A 5 to 10-foot long screen is suitable for

groundwater table wells when the screen is completely submerged and a specific monitoring interval is required;

6. Well slot sizes are described in thousandths of an inch. For most monitoring wells, a No. 10 slot (0.01 inch) well screen is adequate in most hydrostratigraphic units. PVC wells screens are typically available in No. 10 (0.01 inch) or No. 20 (0.02 inch) slot sizes. Stainless steel screens are available in a wider range of slot sizes. Typically, stainless steel screens must be specially ordered and require additional delivery time. Wells screens can be slotted, continuous slot, or louvered. Well points come in very limited slot sizes;
7. The silica sand pack placed around the well screen should be no finer than the slot size of the screen. Grain size curves should be obtained from the driller or well materials supplier to ensure proper sand size prior to placement;
8. All wells must be properly sealed. A seal is placed over the silica sand pack. Cuttings must never be used to seal a well. Certain well applications require specific well seals including bentonite gravel or chips, bentonite grout, cement/bentonite grout, and cement grout. Prior to initiating well installation activities, confirm sealing requirements with local, state/provincial, or federal regulations;
9. Well installation requires the components includes annular space, instrumentation details, filter pack placement, bentonite seal, grouting, protective casings and well caps, surface seal, protective posts (if required);
10. Prior to installation through the auger or into the borehole, the well assembly (i.e., well screen and riser components) and the length of each component must be measured and recorded. The borehole must be measured to ensure installation at the desired interval to be monitored;
11. Placement of the primary filter pack is as follows:

    - The primary filter pack is placed using the tremie line method;
    - A minimum 6 inches of the primary filter pack material is placed under the bottom of the well screen. This interval of primary filter pack provides a firm footing for the well;
    - Where DNAPL is present, or is being monitored for, the well may be sumped into a confining unit. In this case, no primary filter pack is placed under the bottom of the well screen;
    - The top of the primary filter pack is determined in the field based on the geologic and hydrogeologic conditions encountered during borehole advancement;
    - The primary filter pack should extend a minimum of 2 feet above the top of the well screen;

- For shallow overburden wells it is common to extend the primary filter pack to about 2 feet above the water table to account for anticipated seasonal groundwater fluctuations;
- In shallow overburden wells the sand pack should not be extended across a native and fill unit. For deeper overburden wells, it is common to select a specific hydrogeologic unit to monitor; and
- The primary filter pack should never extend through a confining unit causing two or more permeable units to become connected.

12. Placing the primary filter pack by pouring may be acceptable if measurements are taken to ensure that the filter pack is reaching the assigned depth;
13. Install the secondary filter pack. The secondary filter pack is finer than the primary filter pack. The first secondary filter pack prevents the intrusion of grout from reaching the primary filter pack. The final secondary filter pack limits the migration of grout material into the bentonite seal. Generally, a bentonite seal over the primary filter pack is sufficient to stop grout from reaching the primary filter pack;
14. Install a protective casing over the completed well and sealed in place. Once installed and grouted, the casing should extend about 2.5 feet above ground surface. The outer protective casing is made of steel and has a locking cap that is hinged, waterproof, and resistant to vandalism. The protective casing should have sufficient clearance around the inner well casing so that no contact is made with the outer protective casing;
15. Install flush a concrete surface seal to promote drainage away from the outer protective casing at a depth below the frost line to deter frost heaving. Check local, state/provincial, and federal regulations pertaining to requirements for concrete surface seals;

16. The well is installed as follows:

- Before placing the well assembly at the bottom of the borehole, place at least 6 inches of filter pack at the bottom of the borehole to serve as a footing;
- If monitoring for DNAPL, the well assembly may be set directly on the bottom of the borehole. Place the well into the borehole plumb;
- On a well installed to a depth greater than 50 feet, centralizers are required. Place the centralizers on the well casing or well assembly above the proposed bentonite seal interval. Place the centralizers so as

not to interfere with the placement of the filter pack, bentonite seal, and annular grout. (Generally, wells less than 50 feet deep will not require centralizers unless required by local, state/provincial, or federal regulations, or the Work Plan.);

- During well installation through a HSA, slowly pull back the auger as the filter pack, bentonite seal, and annular grout are tremied or poured in place;
- When the well has been lowered into the borehole, place the filter pack around and above the top of the screen, as required;
- When the filter pack has been installed, place a minimum 2-foot thick bentonite seal directly on top of the filter pack;
- Allow the bentonite seal to hydrate for a reasonable amount of time (generally, 30 minutes is sufficient);
- When the bentonite seal has hydrated sufficiently, seal the remaining borehole annular space grout placed with a tremie line using positive displacement methods. Generally, the grout will be brought to 2 feet (0.6 m) below ground surface or below the frost line, whichever is greater. In situations where no concrete seal is being placed, the grout can be brought to 0.5 to 1 foot (0.15 to 0.3 m) below ground surface;
- During grout placement, ensure the end of the tremie line is always submerged in the grout to ensure positive displacement;
- During grout placement on contaminated sites, containerize all fluids for future disposal;
- Allow the grout to set for about 24 hours before installing the concrete surface seal. If the grout level has subsided, top off the borehole annular space with grout or bentonite pellets to the required depth; and
- Install protective casings in a minimum 2-foot (0.6 m) thick concrete surface seal graded to divert surface water away from the monitoring well. Check local, state/provincial, and federal regulations for concrete surface seal requirements. Some agencies require that concrete pads be constructed around the wells.

17. When installation is complete, label the well in at least two locations for future identification;

18. After installation of the monitoring well ensure that monitoring wells are installed and develop properly;
19. Record activities undertaken in the field correctly and completely in a bound field books; and
20. Notify the Project Manager or Project Coordinator of any improprieties or failures on the part of the contractor.

**Surveying Activities**

Geodetic benchmark elevations are established relative to a vertical datum such as Mean Sea Level. Benchmarks (BM), at the national level, are precisely established by federal agencies utilizing first order survey methods and first order instruments. The same high requirements are also specified for state and provincial networks. Wherever possible, the use of geodetic benchmarks is recommended.
Please refer to SOP F-5 for more information on surveying activities.

# Standard Operating Procedure F-16
# Surface Water Sampling Procedures

This standard operating procedure (SOP) sets forth the field procedures for surface water sampling.

## Equipment

Equipment needed for installation of monitoring wells may include the following:

- Teflon bailers;
- Teflon sample bottles/preservatives;
- Ziploc bags;
- Ice;
- Coolers;
- Chain of Custody records, custody seals;
- Field data sheets;
- Decontamination equipment;
- Maps/plot plan;
- Safety equipment;
- Compass;
- Tape measure;
- Camera and film;
- Logbook/waterproof pen; and
- Sample bottle labels.

## Decontamination Procedures

Equipment is decontaminated between sampling locations and prior to leaving the site. Upon completion of the sampling program, all equipment is decontaminated at the site and then returned clean to the appropriate field equipment manager.

For surface water sampling programs, sampling equipment is cleaned as follows:

- Wash with clean potable water and laboratory detergent, using a brush as necessary to remove particulates;
- Rinse with tap water;
- Rinse with deionized water;
- Air dry for as long as possible;

- Rinse with 10-percent nitric acid (only if samples are to be analyzed for metals);
- Rinse with deionized water;
- Rinse with appropriate solvent (pesticide grade isopropanol, methanol, acetone, hexane, if required);
- Rinse again with deionized water;
- Air dry for as long as possible; and
- Wrap samplers in aluminum foil to prevent contamination.

**Surface Water Sampling Procedure**

General

Surface water sampling is performed to obtain samples for surface water bodies that are representative of existing surface water conditions.

Surface water sampling locations for surface water quality and groundwater interaction studies are selected based on the following:

- Study objectives;
- Location of point surface discharges;
- Non point source discharges and tributaries;
- Presence of structures (e.g., bridge, dam); and
- Accessibility.

Surface Water Sample Location Selection

Prior to conducting surface water sampling activities, the first requirement is the consideration and development of surface water sampling locations. It is important that all surface water sampling locations be selected in accordance with the Work Plan and described to and discussed with the Project Coordinator. Representative surface water samples will be collected in sections of surface water bodies that have a uniform cross section and flow rate.

Surface water samples must be collected with no suspended sediments. Surface water samples are collected commencing with the furthest downstream location to avoid sediment interference with upstream locations.

## Sampling Procedure

When collecting surface water samples, direct dipping of the sample container into the stream or water is acceptable unless the sample container contains preservatives. However, surface water samples being analyzed for low level mercury and methyl mercury requires preservatives for both filtered and unfiltered samples. Therefore, a pre-cleaned unpreserved sample container should be used to collect the surface water sample. The surface water sample is then transferred to the appropriate preserved sample container. When collecting surface water samples, submerse the inverted bottle to the desired sample depth and tilt the opening of the sample container upstream to fill. During surface water sample collection, wading or movement may cause sediment deposits to be re-suspended and can result in biased samples. Wading is acceptable if the stream has a noticeable current and the samples are collected directly in the sample container when faced upstream. If the stream is too deep to wade in or if addition samples must be collected at various depths, additional sampling equipment will be required. Surface water samples should be collected about 6 inches (15 cm) below the surface, with the sample bottles being completely submerged. Taking the surface water sample at this depth eliminates the collection of floating debris in the sample container.

Surface water sample collection where the flow depth is less than 1 inch (<2.5 cm) requires the use of special equipment to eliminate sediment disturbance. Surface water sampling may be conducted with a container then transferred to the appropriate sample container, or collection may be performed using a peristaltic pump. A small excavation in the stream bed to create a sump for sample collection can also be considered but should be prepared in advance to allow all the sediment to settle prior to surface water sampling activities.

Teflon™ bailers can be used for surface water sampling if it is not necessary to collect surface water samples at specific depths. A bottom loading bailer with a check ball is sufficient. When the bailer is lowered through the water, the water is continually displaced through the bailer until the desired depth is reached. The bailer is retrieved and the check ball prohibits the release of the collected surface water sample. Bailers are not suitable in surface water bodies with strong currents, or where depth specific sampling is required.

In all instances, properly document all surface water sampling locations in a standard CRA field book. Documentation may include photographs and tie ins to known structures.